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MEMORANDUM

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SUBJECT: PRELIMINARY MONITORING RESULTS OF CARBARYL APPLICATIONS
FOR GLASSY-WINGED SHARPSHOOTER MANAGEMENT IN
RESIDENTIAL AREAS OF FRESNO COUNTY (STUDY 197)

Summary

During June, July, and August 2000, the Fresno County Department of Agriculture's contract applicators applied carbaryl to control the glassy-winged sharpshooter (GWSS) in Fresno County, California. During this time, the Department of Pesticide Regulation (DPR) collected air, tank, leaf, and produce samples at several sites within the cities of Fresno and Clovis. Air samples were taken at five locations before, during and after the applications. The highest concentrations occurred during applications and then declined over the next 48 hours. The highest concentration of 237 parts per trillion (ppt) detected was well below the preliminary health screening level of 6,313 ppt for 24-hour acute exposure to carbaryl. Tank samples showed concentrations ranging from 0.1% to 0.15% of carbaryl active ingredient within the nominal label-rate concentrations of 0.11% to 0.21%. Dislodgeable foliar residue from leaf punches had concentrations ranging from 2.97 to 7.12 $\mu\text{g}/\text{cm}^2$. The ten fruit and vegetable samples collected at preharvest intervals, the required minimum number of days between last application and harvest as determined by the label for "7" Carbaryl Insecticide®, had residues ranging from 0.12 to 1.7 parts per million (ppm) which were below the established tolerance (U.S. EPA maximum allowable residues) of 10 ppm for all produce collected.



Introduction

The Fresno County Department of Agriculture is currently using ground applications of carbaryl to manage infestations of GWSS in California. GWSS (*Homalodisca coagulata*) has become a serious agricultural pest in California. When feeding, it can transmit Pierce's disease, caused by the bacterium *Xylella fastidiosa*, to grapevines, and other diseases to almond trees, alfalfa, citrus, and oleander. First found in the state in 1990, GWSS has spread throughout Southern California and into areas of the San Joaquin Valley.

The Environmental Hazards Assessment Program (EHAP) of DPR, through an interagency agreement and funding from the Department of Food and Agriculture, has been monitoring selected treatments in residential areas to provide information on the concentrations of carbaryl in air, surface water, leaves, and representative backyard fruits and vegetables. Additionally, tank samples have been taken at each air monitoring location. Results reported here are from applications starting June 27 through August 22, 2000 in the cities of Fresno and Clovis in Fresno County. Sampling results and related GWSS monitoring reports are also available at DPR's website <www.cdpr.ca.gov/docs/gwss>.

Materials and Methods

Pesticide Application - In Fresno County approximately 428 infested properties, residential and commercial, were sprayed over 230 acres in the cities of Fresno, Clovis, and Kingsburg. Properties were determined to be infested by Fresno County survey crews. Currently four distinct areas have been treated. In the city of Fresno, one area referred to as the Sunnyside area has undergone treatment three times. Approximately 150 one-acre residential lots were treated starting late June. Two areas in the city of Clovis had been treated at time of monitoring. The Peach/Alluvial area has been treated two times and consists of 193-quarter acre residential lots. The area referred to as Clovis North and South consists of 55 lots and encompasses 22 acres. Treatments were also made in the city of Kingsburg where 29 mainly commercial lots were treated; no monitoring was done. Applications of "7" Carbaryl Insecticide®, with a 41.2% active ingredient, were made by private pest control operators. Pesticides were mixed in water and delivered through an adjustable flow nozzle head (cone tip) attached to a hose from a truck or trailer mounted application equipment (consisting of a tank, engine, pressure gun, and pump). Pressure at the nozzle was maintained between 30 and 60 pounds per square inch (psi) depending on hose length.

Air Sampling - Ambient air samples were collected at five sites in Fresno County (Table 1). Carbaryl applications were made at the Sunnyside area on June 27, 2000 (Site A) and July 25, 2000 (Site D), a second application; at the Peach/Alluvial area (Sites B and C) on July 12, 2000 and a second application was monitored on August 22, 2000; site E in the Clovis area was treated on August 8, 2000.

Table 1. Air monitoring sites for carbaryl, Fresno County, California, **2000**.

Site:	Spray area:	Location:	Application date:
A	Sunnyside	East Geary Street	6/27/00
B	Peach/ Alluvial	West Minarets Avenue.	7/12/00; 8/22/00
C	Peach/ Alluvial	West Birch Avenue	7/12/00
D	Sunnyside	East Atchison Avenue	7/25/00
E	Clovis	East Barstow Avenue	8/8/00

Except for the East Barstow Avenue and the second application of the West Minarets Avenue sites where no background samples were collected, four samples were collected according to the following schedule: (1) Pre-application background for a minimum of 12 hours, (2) duration of application plus one hour, (3) duration of 24 hours after application, and (4) another duration of 24 hours.

Air samples from site A were collected using XAD-4 resin and high volume air samplers (Kurz Instruments) calibrated at 1000 liters-per-minute. Samples from sites B through E were collected using XAD- 2 tubes (SKC#226-30-02) and SKC air samplers (SKC# 224-PCXR8) calibrated at approximately 3 liters per minute. Samplers were located outdoors in open areas. Samples were stored on dry ice until delivery to the California Department of Food and Agriculture's (CDFA) Center for Analytical Chemistry for laboratory analysis. Carbaryl in air, XAD-4, was extracted with acetone and analyzed using high performance liquid chromatography (HPLC) with a fluorescence detector with a reporting detection limit of 1.0 µg (micrograms) per sample (reliable detection level). Carbaryl in XAD-2 was extracted with methanol and analyzed using high performance liquid chromatography with a fluorescence detector with a reporting detection limit of 0.2 µg per sample.

Tank Sampling - One tank sample was collected during the treatment at each air-sampling site. Samples were collected from the hose nozzle into a plastic 500-mL container. Samples were stored separate from other samples on wet ice until delivery to the lab for analysis. Tank samples were extracted with methanol and analyzed using HPLC with an ultra violet detector.

Leaf Sampling - Leaf samples were collected at all sites monitored for air (see Table 1). Each sample consisted of 40 one inch diameter leaf punches collected into a 4 ounce glass jar and sealed with a Teflon®-lined lid. For sites A through D, two samples were collected from each site: one before application (background) and the other after spray had dried (generally one-hour after the application ended). Leaf punches were collected from several plants within each site with the before- and after-application samples collected from the same plants. Samples were taken from a height range of one to six feet from the ground. For sites E and the second monitoring of site B, no background was taken and two samples were taken one hour after the treatment from one type of plant at heights of zero to three feet and from three to six feet from the ground. Samples were stored on wet ice and delivered within 36 hours to the CDFA Center for Analytical Chemistry for analysis where they were analyzed for dislodgeable foliar residue. Leaf samples were washed with SurTen®, extracted with methylene chloride, and analyzed using HPLC with a fluorescence detector. The reporting detection limit is 0.0012 µg/cm² (micrograms per centimeter square).

Produce Sampling - Ten produce samples were collected in Fresno County. Produce samples were obtained where any backyard fruits and vegetables were available and ripe at the air monitoring sites. At the East Geary Street site peach, plum, and lemon were collected; at the West Minarets Avenue site grapes and plums were sampled; and at the East Atchison Avenue site grapes, peach, plum, nectarine, and tomato were sampled. Produce sampled from East Geary Street and West Minarets Avenue were from the first treatment of properties in the Sunnyside and Peach/Alluvial areas of Fresno, samples from East Atchison Avenue were collected after the second round of application in the Sunnyside area.

Each sample consisted of approximately one pound of produce collected into either a quart glass Mason jar with an aluminum foil lined lid or wrapped in aluminum foil and placed in a plastic sealable polyethylene bag. Samples were collected at the preharvest interval, the required minimum number of days between last application and harvest. According to the label for "7" Carbaryl Insecticide® the preharvest intervals are 3 days for tomato, peach, plum and nectarine; 5 days for citrus; and 7 days for grapes. Samples were stored on dry ice during transport or in a freezer at the storage facility until delivered to the CDFA Center for Analytical Chemistry for analysis. Samples were analyzed for total residues by grinding the produce, extracting with acetonitrile, and analyzed using HPLC with a fluorescence detector. The reporting detection limit is 0.05 ppm.

Weather - The applications took place on five different days for the six air monitoring sites. The weather was generally clear and sunny on all application days. On June 27, 2000 temperatures ranged from 68 to 100 degrees with the daily average wind speed of 5 miles-per-hour (mph) from the northwest; July 12, 2000 the temperatures ranged from 61 to 92 degrees with the daily average wind speed of 5 mph from the northwest; July 25, 2000 the temperatures ranged from 61 to 96 degrees with winds from the northwest at 5 mph; August 8, 2000 temperatures ranged from 61 to 96 degrees with winds from the northwest at 4 mph; and on August 22, 2000 temperatures ranged from 57 to 95 degrees with winds from the northwest at 4 mph. Weather data were from CIMIS station #80 at CSU Fresno (UC Davis 2000).

Results

Air - A total of twenty-two air samples were analyzed for carbaryl. Tables 2 displays the results in ppt and $\mu\text{g}/\text{m}^3$ for the six applications monitored. Air concentrations ranged from no detectable amount to $1.9 \mu\text{g}/\text{m}^3$ (micrograms per cubic meter). Of the six applications monitored, none had detections of carbaryl in the background samples. The highest concentration reported was $1.9 \mu\text{g}/\text{m}^3$ from sample taken using the SKC® air sampler during the first interval of the second application at site B. The results show a general declining trend in the concentration of carbaryl over the last two sampling intervals. No carbaryl was detected during the time of application for any of the other samples collected using the SKC® samplers. The low sampling rate and short sampling period probably did not allow for enough carbaryl to be trapped at the detectable limit.

Since enforceable human health standards for carbaryl ambient air concentrations do not exist, DPR has developed screening levels to place results in a health-based context (Sanborn 2000). Although not regulatory standards, DPR will use these screening levels to evaluate the results and take actions as needed. These screening levels represent the first tier in a risk evaluation and provide a context in which to view measured levels of pesticides in this project. A measured air level that is below the screening level for a given pesticide would not be considered to represent a significant health concern and would not generally undergo further evaluation, but should not automatically be considered "safe." By the same token, a measured level that is above the screening level would not necessarily indicate a significant health concern. This set of data is a measurement of acute exposure to carbaryl. The screening level for 24-hour acute exposure to carbaryl is $51.7 \mu\text{g}/\text{m}^3$ (6313 ppt). The maximum concentration detected, $1.9 \mu\text{g}/\text{m}^3$ (237 ppt) is well below the screening level and does not represent a significant health concern.

Table 2. Concentrations of carbaryl in air, Fresno County, California, 2000

Sampler Site	Application Date	Background	ppt ($\mu\text{g}/\text{m}^3$)		
			Interval I During Application	Interval II 24-hour Post Application	Interval III 48-hour Post Application
A'	6/27/00	ND ²	53(0.43)	54(0.44)	37(0.3)
B	7/1 2/00; 8/22/00	ND; NS ^{3,4}	ND; 237 ³	8;41 (0.07;0.33)	ND;16 (0.13)
C	7/12/00	ND	ND	ND	ND
D	7/25/00	ND	ND	24(0.2)	10(0.08)
E	8/8/00	NS	ND	10(0.08)	6(0.04)

Reporting limit (quantifiable concentration) is 6 ppt ($0.05\mu\text{g}/\text{m}^3$).

1. This site monitored using Hi-Vol air sampler; reporting limit is 0.1 ppt ($0.0007\mu\text{g}/\text{m}^3$)

2. ND= non detected at the reporting limit

3. Two numbers reported are for the two treatments monitored

4. NS= not sampled

Tank Mix - Table 3 displays the results for tank samples taken from each air-sampling site. The concentrations ranged from 0.15% to 0.1% active ingredient of carbaryl. Label rates for "7" Carbaryl Insecticide®, active ingredient of 41.2%, generally range from 2 to 4 teaspoon (tsp) per gallon of water for most vegetables, berries, and fruit and nut trees. For control of leafhoppers on trees and ornamentals the label reports a rate of 2 tsp per gallon of water. Theoretical calculations of percent active ingredient for 2 tsp and 4 tsp of product per gallon of water are 0.11% and 0.2 1% active ingredient, respectively.

Table 3. Concentrations of carbaryl in spray tank samples, Fresno County, California, 2000

Site	Date Collected	Carbaryl Concentration (% Active Ingredient)
(A) East Geary Street	6/27/00	0.15
(B) West Minarets Avenue	7/12/00; 8/22/00	0.13; 0.13
(C) West Birch Avenue	7/12/00	0.13
(D) East Atchison Avenue	7/25/00	0.11
(E) East Barstow Avenue	8/8/00	0.1

Leaf Samples - Results from the leaf punch samples taken at the five air monitoring sites are exhibited in Table 4. Two background samples had detectable amounts of carbaryl of 0.06 and 0.11 $\mu\text{g}/\text{cm}^2$ and could be attributed to drift from neighboring properties that were sprayed. The eight post application samples had residues ranging from 2.97 to 7.12 $\mu\text{g}/\text{cm}^2$. These concentrations were comparable to safe reentry levels reported to range from 2.4 to 5.6 $\mu\text{g}/\text{cm}^2$ for the harvest of citrus (Iwata et al. 1979)

Table 4. Dislodgeable foliar residues of carbaryl for different plant species, Fresno County, California, 2000

Site	Carbaryl concentration ($\mu\text{g}/\text{cm}^2$)		Plant type
	Background	One hour after application	
(A) East Geary Street	ND	4.76	Plum, lemon, oleander, birch
(B) West Minarets Avenue	0.11	2.97	Grape, crape myrtle, plum
(B) West Minarets Avenue	NS	5.16; 5.29 ¹	Grape
(C) West Birch Avenue	ND	2.97	Liquid amber, rose
(D) East Atchison Avenue	0.06	3.09	Grape
(E) East Barstow Avenue	NS	7.12; 3.73 ¹	Waxleaf privet

Reporting limit= 0.00 12 $\mu\text{g}/\text{cm}^2$

1. Two numbers are reported; the first number is sample taken at zero to three feet and the second number is sample taken at three to six feet.

Produce Samples - Tolerances are enforceable human health standards in food crops (maximum allowable residue levels) established by the U.S. Environmental Protection Agency (U.S. EPA 1999). All concentrations of carbaryl were below the established tolerance for carbaryl of 10 ppm for all commodities sampled (Table 5). Carbaryl concentrations ranged from no detectable amount on lemon, grapes, tomato, and peach to 1.65 ppm on grapes.

Table 5. Carbaryl concentrations in backyard produce in treatment area, Fresno County, California, 2000.

Site	Date sampled	Carbaryl concentration (ppm) ¹	Produce ²
East Geary Street	6/30/00	0.2	Plum
East Geary Street	6/30/00	0.15	Peach
East Geary Street	7/2/00	ND	Lemon
West Minarets Avenue	7/15/00	0.18	Plum
West Minarets Avenue	7/19/00	ND	Grapes
East Atchison Avenue	7/28/00	0.12	Plum
East Atchison Avenue	7/28/00	ND	Tomato
East Atchison Avenue	7/28/00	1.3	Nectarine
East Atchison Avenue	7/28/00	ND	Peach
East Atchison Avenue	8/1/00	1.7	Grapes

1. Reporting limit= 0.05 ppm

2. US EPA Tolerances = 10 ppm

Disclaimer: The mention of commercial products, their source, or use in connection with material reported herein is not to be construed as either an actual or implied endorsement of such product.

References

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J. Sanborn 2000. Limit of quantitation (LOQ) for carbaryl air monitoring during sharpshooter control. DPR memo June 15, 2000.

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Iwata Y, M. Dusch, G. Carman, and F. Gunther. 1979. Worker Environmental Research: Residues from Carbaryl, Chlorobenzilate, Dimethoate, and Triclorfon Applied to Citrus Trees. J. Agric. Food Chem. 27:1141-1145.

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Carbaryl Monitoring Sites in the Glassy-winged Sharpshooter Treatment Areas, Fresno, Fresno County, Calif., 2000

0 1 2 3 4 Miles

